Utilization of Bioimpedance Spectroscopy in lieu of Invasive Monitoring for Monitoring Fluid Overload

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BACKGROUND

Heart failure (HF) has become one of the leading cost concerns for Medicare and insurance companies due to the expense associated with hospitalizations and subsequent re-admissions. As a result, there has been a push to identify early markers of impending congestion as well as measures of treatment efficacy as means of providing a cost savings and value in the management of HF.

AIMS

To compare changes in pulmonary artery pressure to impedance parameters as measured by bioimpedance spectroscopy, in patients with NYHA Class II-III heart failure.

METHODS

Patients with NYHA Class II-III heart failure who fulfilled eligibility criteria were recruited for this study. Patients attended the outpatient clinic of Scripps Memorial Hospital, La Jolla, 3 times per week for 4 weeks. Baseline demographics, surgical and medical history were documented.

Bioimpedance measures of whole body, arms and legs were performed using a bioimpedance spectroscopy (BIS) device (SOZO, ImpediMed, Qld, Australia). BIS measures provide impedance values at both zero (extracellular fluid) and infinite (total body water) frequencies. As fluid increases impedance decreases in an inversely proportional manner. BIS allows the extracellular and total body fluid to be tracked accurately and noninvasively.

In addition to bioimpedance measures, pulmonary artery pressure (CardioMEMS device (Abbott Laboratories, Atlanta, Georgia) or transthoracic echocardiogram) and weight were recorded at each visit.

CASE PRESENTATION

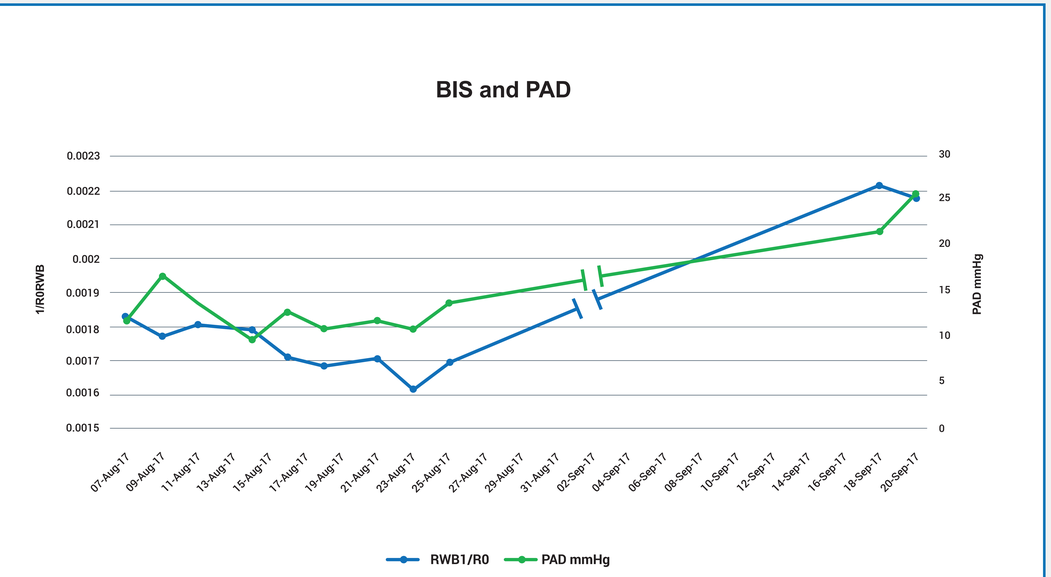
A case study of the first patient is presented here. His advanced heart failure required changes in his diuretic regiment to maintain euvolemia. Because of history of cirrhosis, his fluid status was difficult to estimate by weight alone. His weight, mental acuity, as well as PA pressures were utilized to guide therapy and close phone follow up was utilized to assess his well-being and level of function. As his fatigue increased and diastolic pulmonary pressures dropped there was a decreased adjustment to his diuretic therapy.

DISCUSSION

On August 18th, his diastolic pulmonary pressure artery decreased to 11 mmHg from a previous measure of 13 mmHg (August 16th). Fatigue coupled with objective data resulted in a diagnosis of dehydration and a subsequent reduction in diuretic dose. His weight increased, diastolic PA pressure rose and his impedance level dropped.

On the 23rd, his diastolic PA pressure dropped again and his diuretic (Lasix) was discontinued. As a result of this medicine change, his diastolic PA pressure rose, and his impedance dropped.

On the 26th, he presented to the ER with confusion and dry mucus membranes. He was managed by the internal medicine service for hepatic encephalopathy and given fluids as well as bowel care. Upon discharge from the hospital, the patient was considerably overhydrated based on weight, diastolic pulmonary pressures, and systolic blood pressure. Diuresis was reinstituted, and the patient considered palliative options for future care. His hydration status throughout the continuum was monitored by the diastolic pulmonary pressure of the CardioMEMS unit and correlates well with the BIS measurements from the SOZO device.

CONCLUSIONS

The findings from this case suggest that BIS may provide an additional noninvasive tool to detect extracellular fluid excess and impending congestion before hospitalization. BIS correlates well with diastolic PA pressures and may prove a useful adjunct in the management of HF. Further research is needed in a larger more diverse group of patients to assess the role BIS plays in the management of HF.